

Article
19 Entered

What is claimed is:

1. A method for determining when to inject a coating for contacting a surface of a molded article in a mold in an in-mold coating process, the method comprising the steps of:

determining an internal mold pressure after a mold has been filled with a predetermined amount of a thermoplastic;

monitoring over time the internal mold pressure as said thermoplastic cools in the mold; and

determining from a change in the internal pressure that a surface of said thermoplastic has cooled to below its melt temperature.

2. A method according to claim 1, wherein said change in internal pressure is a reduction in pressure.

3. A method according to claim 1, wherein the internal pressure rises as said thermoplastic is injected into said mold, and subsequently decreases as said thermoplastic cools.

4. A method for in-mold coating a thermoplastic substrate, the method comprising the steps of:

injecting a thermoplastic substrate into a closed mold, wherein at least one of an internal mold temperature and an internal mold pressure is monitored;

allowing a surface of said thermoplastic to cool to a point below its melting temperature to form a molded article;

injecting a coating into said closed mold such that said coating contacts at least a part of said surface of said thermoplastic, wherein said coating is injected at a point wherein at least one of said internal mold temperature and internal mold pressure is indicative of the point when said thermoplastic has cooled to below its melting temperature.

5. A method according to claim 4, wherein said internal mold temperature and internal mold pressure is measured by a sensor.
6. A method according to claim 5, wherein a measurement determined by said sensor is relayed to a control apparatus controlling the injection of said coating.
7. A method for ensuring the quality of in-mold coated thermoplastic parts, the method comprising the steps of:
 - a) manufacturing an in-mold coated thermoplastic part by molding a thermoplastic using a first set of process conditions in a closed mold to form a substrate and subsequently contacting an in-mold coating with said substrate by injecting an in-mold coating into said closed mold;
 - b) inspecting the coated thermoplastic part;
 - c) determining whether the molding of the thermoplastic should be optimized for failure to meet defined quality control standards;
 - d) optimizing the process conditions of the molding of the thermoplastic by adjusting one or more of injection volume, injection temperature, injection pressure, and molding pressure;
 - e) determining whether the coating of the substrate should be optimized for failure to meet defined quality control standards; and
 - f) optimizing the process conditions of the coating of the substrate by adjusting one or more of cure time, injection time, injection pressure, injection volume, injection temperature, or mold temperature at injection for said in-mold coating.
8. A method according to claim 7, wherein step c) is performed by determining whether said thermoplastic substrate exhibits at least one of voids and inadequate filling of said mold.
9. A method according to claim 7, wherein said first set of process conditions includes: one or more injection pressures for said thermoplastic, one

or more injection temperatures for said thermoplastic, one or more injection volumes for said thermoplastic, one or more injection times for said thermoset, one or more injection pressures for said thermoset, one or more injection volumes for said thermoset, and one or more cure times for said thermoset.

10. A method according to claim 7, wherein step e) is performed by at least one of determining whether said coating is intermingled with said substrate, determining whether a surface appearance of said coating is acceptable for a defined end use, and determining whether there is sufficient adhesion between said coating and said substrate.

11. A method according to claim 7; wherein said coating is injected into said mold at a point after said thermoplastic has cooled to a temperature below its melt temperature.

12. A method according to claim 11 wherein said point is determined by the monitoring of a temperature in said mold.

13. A method according to claim 11, wherein said point is determined by the monitoring of an internal pressure in said mold.

14. A method according to claim 7, wherein steps a) – f) are performed repeatedly until an in-mold coated thermoplastic part is produced that meets defined quality standards.

15. A method according to claim 7, wherein step f) is performed by at least one of 1) adjusting a time at which said in-mold coating is injected into said mold relative to a time at which the molding process is begun, and 2) adjusting a time at which said mold is opened and the coated part is removed from said mold relative to a time at which said in-mold coating is injected into said mold.

16. A method according to claim 7, wherein step f) is performed by adjusting an injection pressure for said in-mold coating.
17. A method according to claim 7, wherein values for one or more of said process conditions for said molding and coating steps are controlled and recorded by a control apparatus operatively associated with said mold.
18. A method according to claim 7, wherein said optimized process conditions are stored in a control apparatus associated with said mold and may be recalled for use in future molding processes.